Claims

1.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

characterized in that if a height from the surface of the substrate which is in contact with the protective film to a top part of a convex portion of the protective film is t, a height from the surface of the substrate which is in contact with the protective film to a bottom part of a concave portion of the protective film is t1, a height (t-t1) from the top part of the convex portion of the protective film to the bottom part of the concave portion of the protective film is t2, a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of the convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a pitch width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, a width between the electrode fingers is p2, and a film thickness of the comb-type electrode is h, that satisfies,

$t2 \leqq h$

(herein, correlations of $L \fallingdotseq p$, $p1 + p2 = p$, $L1 + pL2 = L$, $L1 \leqq p1$ and

L2$\geq$p2 are satisfied).

2.   The electronic part according to claim 1, characterized in that in the comb-type electrode which is disposed on the substrate, a correlation between the film thickness h of the comb-type electrode and the pitch width p of one pitch of the comb-type electrode is,

0.05$\leq$h/(2$\times$p).

3.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

characterized in that if a height from the surface of the substrate which is in contact with the protective film to a top part of a convex portion of the protective film is t, a height from the surface of the substrate which is in contact with the protective film to a bottom part of a concave portion of the protective film is t1, a height (t-t1) from the top part of the convex portion of the protective film to the bottom part of the concave portion of the protective film is t2, a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of the convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave

portion is L2, a pitch width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, a width between the electrode fingers is p2, and a film thickness of the comb-type electrode is h, that satisfies,

$h \leqq t2$

(herein, correlations of $L \doteqdot p$, $p1 + p2 = p$, $L1 + pL2 = L$, $L1 \leqq p1$ and $L2 \geqq p2$ are satisfied).

4. The electronic part according to claim 3, characterized in that in the comb-type electrode which is disposed on the substrate, a correlation between the film thickness h of the comb-type electrode and the pitch width p of one pitch of the comb-type electrode is,

$h/(2 \times p) \leqq 0.05$.

5. The electronic part according to claim 1 or claim 3, characterized in that if a ratio L1/L of the width L1 of one pitch of the convex portion of the unevenness in the uneven shape of the protective film to the pitch width L of one pitch of the protective film is η' and a ratio p1/p of the width p1 of one of the electrode fingers which form the comb-type electrode to the pitch width p of one pitch of the comb-type electrode is η, then a correlation between η and η' is,

$\eta'/\eta \leqq 0.86$

(herein, correlations of $L \doteqdot p$, $p1 + p2 = p$ and $L1 + L2 = L$ are

satisfied).

6.   The electronic part according to claim 1 or claim 3, characterized in that if a center of the width L1 of one pitch of the convex portion of the unevenness of the protective film is Lc and a center of the width p1 of the electrode finger of the comb-type electrode which is located under the pitch of the convex portion of the protective film is pc, then Lc and pc are, in plan view, substantially on a same straight line.

7.   The electronic part according to claim 1 or claim 3, characterized in that if the substrate is a lithium-tantalate substrate and a cutout angle of the lithium-tantalate substrate is $D°$ as a rotational angle thereof around an X-axis against a Z-axis direction, then the substrate is cut out of a Y-sheet at an angle which satisfies,

$$38° \leqq D° \; .$$

8.   The electronic part according to claim 1 or claim 3, characterized in that with respect to the comb-type electrode which is disposed on the upper surface of the substrate and the protective film which covers the comb-type electrode and has the uneven shape at the top surface thereof, the correlation between the height t1 from the surface of a substrate which is in contact with the protective film to

the bottom part of the concave portion of the protective film and the pitch width p of one pitch of the comb-type electrode is,

$13\% \leqq t1/(2 \times p) \leqq 35\%$.

9. The electronic part according to claim 1 or claim 3, characterized in that the protective film is silicon dioxide.

10. An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode, a top surface of the protective film being substantially flat,

characterized in that when a height from the surface of the substrate which is in contact with the protective film to the top surface of the protective film is t and a pitch width of one pitch of the comb-type electrode is p, if the substrate is a lithium-tantalate substrate and a cutout angle of the lithium-tantalate substrate is D° as a rotational angle thereof around an X-axis against a Z-axis direction, then the substrate is cut out of a Y-sheet at an angle which satisfies,

$38^{\circ} \leqq D^{\circ}$, and

that satisfies,

$13\% \leqq t/(2 \times p) \leqq 35\%$.

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11.   The electronic part according to claim 10, characterized in that in the comb-type electrode which is disposed on the substrate, a correlation between a film thickness h of the comb-type electrode and a pitch width p of one pitch of the comb-type electrode is,

$$0.05 \leqq h/(2 \times p).$$

12.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

characterized in that if a height from the surface of the substrate which is in contact with the protective film to the top part of a convex portion of the protective film is t, a height from the surface of the substrate which is in contact with the protective film to a bottom part of a concave portion of the protective film is t1, a height (t−t1) from the top part of the convex portion of the protective film to the bottom part of the concave portion of the protective film is t2, a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of the convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a ratio (L−L2)/L of (L−L2) to the pitch width L is η', a height of the comb-type electrode is h, a pitch

width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, a width between the electrode fingers is p2, and a ratio p1/p of the width p1 of the electrode finger to the pitch p of the comb-type electrode is η, that satisfies,

$h \leqq t2$

(herein, correlations of $\eta' - 0.3 < \eta \leqq \eta'$, $L \fallingdotseq p$, $p1 + p2 \fallingdotseq p$ and $L1 > p1$ are satisfied).

13.   The electronic part according to claim 12, characterized in that a correlation between one pitch of the protective film and the width p2 between adjacent electrode fingers of the comb-type electrode is,

$L1 + L2 < L$ and $L2 < p2$

(herein, a correlations of $L \fallingdotseq p$ and $p1 + p2 \fallingdotseq p$ are satisfied).

14.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

        characterized in that if a height from the surface of the substrate which is in contact with the protective film to a top part of a convex portion of the protective film is t, a height from the surface of the substrate which is in contact with the protective film to a bottom part of

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a concave portion of the protective film is t1, a height (t−t1) from the top part of the convex portion of the protective film to the bottom part of the concave portion of the protective film is t2, a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of the top part of the convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a height of the comb-type electrode is h, a pitch width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, and a width between the electrode fingers is p2, that satisfies,

$h \leqq t2$

(herein, correlations of $L1+L2 < L$, $L2 < p2$, $L1 \leqq p1$, $L \fallingdotseq p$ and $p1+p2 \fallingdotseq p$ are satisfied).

15.   The electronic part according to claim 12 or claim 14, characterized in that in the comb-type electrode, a correlation between the height h of the comb-type electrode and the pitch width p of one pitch of the comb-type electrode is,

$h/(2 \times p) < 0.05$.

16.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the

comb-type electrode and has an uneven shape at the top surface thereof,

characterized in that if a height from the surface of the substrate which is in contact with the protective film to the top part of a convex portion of the protective film is t, a height from the surface of the substrate which is in contact with the protective film to a bottom part of a concave portion of the protective film is t1, a width (t−t1) from the top part of the convex portion of the protective film to the bottom part of the concave portion of the protective film is t2, a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of the convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a ratio (L−L2)/L of (L−L2) to the pitch width L is η', a height of the comb-type electrode is h, a pitch width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, a width between the electrode fingers is p2, and a ratio p1/p of the width p1 of the electrode finger to the pitch p of the comb-type electrode is η, that satisfies,

$0 < t2 < h$

(herein, correlations of $\eta' - 0.3 < \eta \leq \eta'$, $L \fallingdotseq p$, $p1 + p2 \fallingdotseq p$ and $L1 > p1$ are satisfied).

17.   The electronic part according to claim 16,

characterized in that a correlation between one pitch of the protective film and the width p1 between adjacent electrode fingers of the comb-type electrode is,

$L1+L2 < L$ and $L1 < p1$

(herein, correlations of $L \fallingdotseq p$ and $p1+p2 \fallingdotseq p$ are satisfied).

18.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

characterized in that if a height from the surface of the substrate which is in contact with the protective film to a top part of a convex portion of the protective film is t, a height from the surface of the substrate which is in contact with the protective film to a bottom part of a concave portion of the protective film is t1, a width (t-t1) from the top part of the convex portion of the protective film to the bottom part of the concave portion of the protective film is t2, a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of the top part of the convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a height of the electrode finger is h, a pitch width of one pitch of the comb-type electrode is p, a width of one of the electrode fingers which form

the comb-type electrode is p1, and a width between the electrode fingers is p2, that satisfies,

$0 < t2 < h$

(herein, correlations of $L1 + L2 < L$, $L2 < p2$, $L1 \leqq p1$, $L \fallingdotseq p$ and $p1 + p2 \fallingdotseq p$ are satisfied).

19.   The electronic part according to claim 16 or claim 18, characterized in that in the comb-type electrode, a correlation between the height h of the comb-type electrode and the pitch width p of one pitch of the comb-type electrode is,

$0.05 \leqq h/(2 \times p)$.

20.   The electronic part according to any one of claims 12, 14, 16 and 18, characterized in that if the substrate is made of lithium tantalate and a cutout angle of the lithium-tantalate substrate is $D°$ as a rotational angle thereof around an X-axis in a Z-axis direction, then the substrate is cut out of a Y-sheet at an angle which satisfies,

$38° \leqq D°$.

21.   The electronic part according to any one of claims 12, 14, 16 and 18, characterized in that with respect to the protective film, if a height from the surface of the substrate to the concave portion of the protective film is t1, that satisfies,

$$18\% \leqq t1/(2 \times p) \leqq 35\%.$$

22.   The electronic part according to any one of claims 12, 14, 16 and 18, characterized in that the protective film is silicon dioxide.

23.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

characterized in that if a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of a convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a ratio $(L-L2)/L$ of $(L-L2)$ to the pitch width L is η', a pitch width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, a width between the electrode fingers is p2, and a ratio p1/p of the width p1 of the electrode finger to the pitch p of the comb-type electrode is η, that satisfies,

$$\eta'-0.3 < \eta \leqq \eta'$$

(herein, correlations of $L \fallingdotseq p$, $p1+p2=p$ and $L1 > p1$ are satisfied).

24.   The electronic part according to claim 23,

characterized in that a correlation between one pitch of the protective film and the width p2 between adjacent electrode fingers of the comb-type electrode is,

$L1+L2<L$ and $L2<p2$

(herein, correlations of $L \fallingdotseq p$ and $p1+p2 \fallingdotseq p$ are satisfied).

25.   An electronic part which includes a substrate, a comb-type electrode that is disposed on an upper surface of the substrate, and a protective film that covers the comb-type electrode and has an uneven shape at a top surface thereof,

characterized in that if a pitch width of one pitch in the uneven shape of the protective film is L, a width of one pitch of a convex portion of an unevenness in the uneven shape of the protective film is L1, a width of one pitch of the concave portion is L2, a pitch width of one pitch of the comb-type electrode is p, a width of one of electrode fingers which form the comb-type electrode is p1, and a width between the electrode fingers is p2, that satisfies,

$L1+L2<L$, $L2<p2$ and $L1 \leqq p1$.

(herein, correlations of $L \fallingdotseq p$ and $p1+p2 \fallingdotseq p$ are satisfied).

26.   The electronic part according to claim 23 or 25, characterized in that if the substrate is made of lithium tantalate and a cutout angle of the lithium-tantalate substrate is D° as a rotational angle thereof around an X-axis in a

Z-axis direction, then the substrate is cut out of a Y-sheet at an angle which satisfies,

$$38° \leqq D°.$$

27.   The electronic part according to claim 23 or 25, characterized in that with respect to the protective film, if a height from the surface of the substrate to the concave portion of the protective film is t, that satisfies,

$$18\% \leqq t/(2 \times p) \leqq 35\%.$$

28.   The electronic part according to claim 23 or 25, characterized in that the protective film is silicon dioxide.

29.   Electronic equipment which includes at least one antenna and an electric circuit that is electrically connected to the antenna,

characterized in that the electric circuit is provided with a plurality of electronic parts, and at least one of these plurality of electronic parts is the electronic part according to any one of claims 1 to 28.